

Docket No.: P-0306



PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF APPEALS AND INTERFERENCES**

In re Application of

Confirmation No.: 5310

Woo Sik KIM et al.

Group Art Unit: 2633

Serial No.: 10/023,745

Examiner: Christina Y. LEUNG

Filed: 12/21/2001

**Customer No.: 34610**

For: SIGNAL TRANSMISSION APPARATUS AND METHOD FOR OPTICAL  
BASE STATION

**TRANSMITTAL OF APPEAL BRIEF**

U.S. Patent and Trademark Office  
Customer Window, Mail Stop Appeal Brief-Patents  
Randolph Building  
401 Dulany Street  
Alexandria, Virginia 22314

Sir:

Submitted herewith is Appellant's Appeal Brief in support of the Notice of Appeal filed February 23, 2006. Enclosed is Check No. 17685 for the Appeal Brief fee of \$500.00 and Extension of Time fee of \$120.00.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,  
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**Date: May 23, 2006**

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**APPEAL BRIEF**

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Randolph Building  
401 Dulany Street  
Alexandria, Virginia 223134

Sir:

This appeal is taken from the final rejection of claims as set forth in the Office Action of August 24, 2005 (hereafter the Office Action). In accordance with 37 C.F.R. §41.37, applicants address the following items.

**REAL PARTY IN INTEREST**

The party in interest is the assignee, LG Electronics Inc. The assignment document is recorded beginning at Reel 012406 and Frame 0120.

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**RELATED APPEALS AND INTERFERENCES**

There are no known related appeals and/or interferences.

**STATUS OF THE CLAIMS**

This is an appeal from the final rejection dated August 24, 2005 of claims 1-19, 21, 26, 28-38 and 40-42. No other claims are pending.

**STATUS OF AMENDMENTS**

An Amendment After Final Rejection was filed on December 22, 2005. This Amendment has been entered for purposes of appeal. See the Advisory Action dated February 7, 2006.

A Second Amendment After Final Rejection was filed on April 21, 2006. At the time of filing this brief, this Amendment has not yet been entered. A copy of the claims on appeal prior to entry of the Second Amendment After Final Rejection is provided in Claims Appendix B.

Since the Second Amendment After Final Rejection is in full compliance with 37 C.F.R. §1.116 and 37 C.F.R. §41.33(a), applicant believes the amendments will be entered. Accordingly, a copy of the appealed claims 1-19, 21, 26, 28-38 and 40-42 is provided in the attached Claims Appendix A. The following discussion relates to the claims in Claims Appendix A.

**SUMMARY OF THE CLAIMED SUBJECT MATTER**

As stated in 37 C.F.R §41.37(c) (v), applicants are providing the following explanation of each of the independent claims 1, 11, 18, 26, 31 and 33 involved in this appeal. This explanation refers to the specification and drawings. The following is merely an example summary and is not intended to be a discussion of the full and entire scope of the claims. Other interpretations, configurations and embodiments are also within the scope of the pending claims.

**Independent Claim 1**

A communications system is disclosed. The system may include a base station configured to output first digital in phase and quadrature phase (I/Q) signals. For example, paragraph [42] describes a base station 11 to output a digital I/Q signal. See also FIGs. 5 and 6.

The system may also include an optical connecting unit configured to convert the first digital I/Q signals into optical signals and output the converted optical signals through an optical cable. For example, paragraph [42] describes an optical connecting unit 78 to convert digital I/Q signals outputted from the base station 11 into an optical signal and output the optical signal through an optical cable 90. See also FIGs. 5 and 6.

Still further, the system may include an optical base station coupled to receive the optical signals through the optical cable and configured to convert the optical signals into second digital I/Q signals, and convert the second digital I/Q signals into first RF signals for transmission. For example, paragraph [42] describes a remote station 108 to convert the converted digital I/Q signal into a high power RF signal. See also FIGs. 5 and 6.

**Independent Claim 11**

A signal transmitting method for a communications system is also disclosed. The method may include converting first digital I/Q signals outputted from a base station into optical signals. For example, paragraph [42] describes an optical connecting unit 78 to convert digital I/Q signals outputted from a base station 11 into an optical signal and output the optical signal through an optical cable 90.

The method may also include transmitting the optical signals through an optical cable to an optical base station. For example, paragraph [42] describes the optical connecting unit 78 outputting the optical signal through the optical cable 90.

Still further, the method may include converting the optical signals received through the optical cable into second digital I/Q signals. For example, paragraph [42] describes converting the optical signal received through the optical cable 90 into a digital I/Q signal.

The method may also include converting the second digital I/Q signals into RF signals. For example, paragraph [42] describes converting the converted digital I/Q signal into a high power RF signal.

Additionally, the method may include transmitting the RF signals through an antenna. For example, paragraph [42] describes transmitting the high power RF signal to an antenna 116. Additionally, paragraph [51] describes the signal is transmitted through the antenna 116.

**Independent Claim 18**

A signal receiving method for a communications system is also disclosed. The method may include receiving RF signals through an antenna of a remote base station. For example, paragraph [52] describes a dual purpose antenna 116 for transmission and reception, and a reception dedicated antenna 118. The antennas 116 and 118 apply the received RF signal to duplexers 150 and 150'.

The method may also include converting the received RF signals to first digital electronic signals. For example, paragraph [53] describes that down-converter units 225 and 225' filter the inputted RF signal, down-convert, analog/digital convert and generate a digital I/Q signal.

The method may also include converting the first digital electronic signals to digital optical signals. For example, paragraph [55] describes that the optical transceiver 125 converts the digital signal into an optical signal.

The method may also include transmitting the digital optical signals over an optical link to an optical connecting unit. For example, paragraph [55] describes that the converted optical signal is transmitted through the optical cable 90 to an optical connecting unit 78.

The method may also include converting the digital optical signals to second digital electronic signals in the optical connecting unit, the second digital electronic signals including in phase and quadrature phase (I/Q) signals. For example, paragraphs [56] and [58] describe receiving the optical signal from the optical cable 90 and performing various operations including converting the I/Q signals and outputting digital I/Q signals.

Additionally, the method may also include providing the second digital electronic signals from the optical connecting unit to a base station. For example, paragraph [57] describes that the digital I/Q signal is transmitted to the base station 11.

#### **Independent Claim 26**

A signal transmitting method in a communication system is also disclosed. The method may include receiving digital I/Q signals from a base station. For example, paragraph [42] describes a base station 11 to output a digital I/Q signal.

The method may also include converting the digital I/Q signals to optical signals in an optical connecting unit. For example, paragraph [42] describes an optical connecting unit 78 converting digital I/Q signals into an optical signal.

The method may also include transferring the optical signals over an optical cable to a remote station. For example, paragraph [42] describes outputting the optical signal through an optical cable 90 and a remote station 108 receiving the signal.

The method may also include converting the optical signals into RF signals for transmission. For example, paragraph [42] describes converting the converted I/Q signal into a high power RF signal, and transmitting the high power RF signal to an antenna 116.

#### **Independent Claim 31**

A communication system is also disclosed. The system may include an optical connecting unit, configured to receive first digital I/Q signals and convert the first digital I/Q signals into first digital optical signals. For example, paragraph [42] describes an optical connecting unit 78 to

convert digital I/Q signals outputted from a base station 11 into an optical signal and outputting the optical signal through an optical cable 90.

The system may also include a remote base station, coupled to receive the first digital optical signals and configured to convert the first digital optical signals to first analog RF signals for transmission. For example, paragraph [42] describes a remote station 108 to convert the converted digital I/Q signal into a high power RF signal, and transmitting the high power RF signal to an antenna 116.

### **Independent Claim 33**

A communication system is also disclosed. The system may include an optical connection unit, configured to convert first digital I/Q signals to first optical signals and to convert second optical signals to second digital I/Q signals. For example, paragraph [42] describes an optical connecting unit 78 to convert digital I/Q signals outputted from a base station 11 into an optical signal and output the optical signal through an optical cable 90.

The system may also include a remote base station, coupled to receive the first optical signals, and configured to convert the first optical signals to third digital I/Q signals, convert the third digital I/Q signals to first RF signals, transmit the first RF signals, receive second RF signals, convert the second RF signals to fourth digital I/Q signals, and convert the fourth digital I/Q signals to the second optical signals. For example, paragraph [42] describes a remote station 108 to convert the converted digital I/Q signal into a high power RF signal, and transmitting the high power RF signal to an antenna 116. Additionally, paragraph [51] describes the signal as



transmitted through the antenna 116. Still further, paragraphs [52], [53] and [55] describe receiving RF signals, converting the received RF signals to digital I/Q signals and converting the digital signals to optical signals.

### **GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

Claims 1-2, 6-8 and 10-42 stand rejected under 35 U.S.C. §102(b) over U.S. Patent 5,627,879 to Russell et al. (hereafter Russell).

Claims 3-5 stand rejected under 35 U.S.C. §103(a) over Russell and U.S. Patent 5,067,173 to Gordon et al. (hereafter Gordon).

Claim 9 stands rejected under 35 U.S.C. §103(a) over Russell.

As discussed below in the section entitled "Argument" applicants have separately made arguments for each of the claims. Applicants believe that each of the claims stands and falls separately from one another.

### **ARGUMENT**

The present application contains six independent claims, namely independent claims 1, 11, 18, 26, 31 and 33. These claims contain different features as may be evidenced by the specifically claimed features and/or as may be pointed out above and/or below. For ease of illustration and discussion, similar types of claims (or claim features) may be discussed with respect to each other. This is not an admission that the claims are the same or that they stand or fall together. Rather, this is an attempt to narrow the number of issues and to limit the number

of arguments. While arguments may be similar for different claims, it should be understood that differently claimed features are expressly used.

Applicants are providing arguments below to show that the applied references do not teach or suggest the claimed features. Each of independent claims is believed to define patentable subject matter as discussed below. Each of the dependent claims depends from at least one of the independent claims and therefore defines patentable subject matter at least for this additional reason. In addition, the dependent claims recite features that further and independently distinguish over the applied references.

### **Independent Claim 1**

Independent claim 1 recites a base station, an optical connecting unit and an optical base station. Independent claim 1 also recites the base station configured to output first digital in phase and quadrature phase (I/Q) signals. The optical connecting unit configured to convert the first digital I/Q signals into optical signals and output the converted optical signals through an optical cable. Additionally, independent claim 1 recites the optical base station coupled to receive the optical signals through the optical cable and configured to convert the optical signals into second digital I/Q signals, and convert the second digital I/Q signals into first RF signals for transmission.

Russell does not teach or suggest at least these features of independent claim 1. In particular, the Office Action (on page 2) asserts that the claimed base station is shown as Russell's base station 330 (FIG. 17), head end unit 332 and AM modulator/demodulator 338

(FIGs. 27B-28). However, Russell's head end unit 332 and the AM modulator/demodulator 338 do not correspond to the claimed base station. One skilled in the art would clearly understand the meaning of a base station as the terminology "base station" is well known to one skilled in the communications art. One skilled in the art will clearly recognize that Russell's base station 330 (FIG. 17) would not include the head end unit 332 and the AM modulator/demodulator element 338. For example, in FIG. 17, the base station 330 is coupled to the head end unit 332 by fibers 331A and 331B. One skilled in the art will clearly understand that a base station does not include fibers that are connected to a head end unit as well being coupled to an AM modulator/demodulator. Russell discloses that the base station 330 may be positioned remote from the head end or, alternatively, may be located at the head end such that that the RF signal output from the transmitters (of the base station) may be filtered and applied to the modulator/demodulator 338. That is, Russell clearly discloses that the base station 330 outputs RF signals. See column 15, lines 31-48 as well as FIG. 3.

The Advisory Action (on page 2) states that Russell's terminology differs slightly from the recited claims and that all the elements disclosed by Russell nevertheless constitute a "base station." Applicant maintains that claim 1 recites a base station and that Russell specifically discloses a base station 330. Russell does not utilize different terminology as set forth in the Advisory Action. Rather, both claim 1 and Russell refer to a base station. The Advisory Action appears to assert that it is acceptable to expand the definition of a base station and add additional components. There is no basis in the art for Russell's base station to include components

outside of the box labeled 330 in FIG. 17.

Russell does not teach or suggest a base station configured to output first digital in phase and quadrature phase (I/Q) signals as recited in independent claim 1. Stated differently, there is no suggestion to interpret Russell's base station 330 so as to include the head end unit 332 and the AM modulator/demodulator 338. These features are not part of a base station as would be understood to one skilled in the art.

Independent claim 1 further recites an optical base station. The Office Action (on page 2) asserts that Russell's optical node 342 (FIGs. 17 and 29) corresponds to the claimed optical base station. However, applicants respectfully submit that the optical node 342 is not an optical base station. Furthermore, FIG. 29 is described as being related to an optical node (as compared to a base station). See column 6, lines 59-61. There is no suggestion in Russell for the features of an optical base station as would be known to one skilled in the art.

For at least the reasons set forth above, Russell does not teach or suggest all the features of independent claim 1. Accordingly, independent claim 1 defines patentable subject matter.

### **Dependent Claim 2**

Dependent claim 2 depends from independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 2 contains additional features such that dependent claim 2 does not stand or fall together with independent claim 1. For example, dependent claim 2 recites that the optical base station includes an optical transceiver, a multiplex/demultiplexer unit, an up-converter, a High Power Amplifier and a duplexer.

Dependent claim 2 further recites the optical transceiver configured to convert the optical signals received through the optical cable into the second digital I/Q signals. The multiplexer/demultiplexer unit configured to demultiplex the second digital I/Q signals outputted from the optical transceiver. The up-converter configured to convert and filter output signals of the multiplexer/demultiplexer unit and output the first RF signals. The High Power Amplifier (HPA) configured to amplify the first RF signals outputted by the up-converter. The duplexer configured to filter the amplified first RF signals and provide the filtered output to an antenna.

The Office Action (on page 3) cites Russell's FIG. 29 as disclosing the features of dependent claim 2. However, FIG. 29 does not suggest the features of an optical base station. Russell does not teach or suggest these features of dependent claim 2 either alone or in combination with the other features of independent claim 1. Thus, dependent claim 2 defines patentable subject matter at least for this additional reason.

### **Dependent Claim 3**

Dependent claim 3 depends from dependent claim 2 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 3 contains additional features such that dependent claim 3 does not stand or fall together with independent claim 1 and/or dependent claim 2. For example, dependent claim 3 recites that the optical base station further includes a plurality of duplexers, a plurality of Low Noise Amplifiers and a plurality of down-converter units. The plurality of duplexers configured to remove a noise

component of second RF signals collected by a corresponding plurality of antennas. The plurality of Low Noise Amplifiers (LNAs) configured to amplify the second RF signals outputted from the plurality of duplexers. The plurality of down-converter units configured to band-pass filter, down-convert and analog to digital convert, the second RF signals outputted from the plurality of LNAs.

The Office Action (on pages 12-13) agrees that Russell does not disclose the claimed plurality of duplexers or plurality of Low Noise Amplifiers. The Office Action appears to rely on Gordon as showing a plurality of amplifiers. However, there is no suggestion in Russell or Gordon to provide a plurality of duplexers. The Office Action merely asserts that a plurality of duplexers would have been obvious. No applied reference teaches these claimed features. In view of this, there also is no teaching of a plurality of LNAs to amplify signals output from a plurality of duplexers. Gordon does not teach these features. Accordingly, the applied references do not teach or suggest these features of dependent claim 3 either alone or in combination with the other features of independent claim 1 and/or dependent claim 2. Thus, dependent claim 3 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 4**

Dependent claim 4 depends from dependent claims 2 and 3 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 4 contains additional features such that dependent claim 4 does not stand or fall together with independent claim 1 and/or dependent claims 2 and 3. For example, dependent claim 4 recites

that the optical base station further comprises a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.

The Office Action (on page 13) cites Russell's col. 31, lines 10-18 for these features. However, this cited section does not relate to a clock unit to provide a signal (or a synchronous signal) to a multiplexer/demultiplexer unit. Thus, the applied references do not teach or suggest these features of dependent claim 4 either alone or in combination with the other features of each of claims 1-3. Thus, dependent claim 4 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 5**

Dependent claim 5 depends from dependent claims 2-4 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 5 contains additional features such that dependent claim 5 does not stand or fall together with independent claim 1 and/or dependent claims 2-4. For example, dependent claim 5 recites that the optical base station further comprises a reference clock unit configured to provide the synchronous signal of the clock unit to the up-converter unit and the plurality of down-converter units.

The Office Action (on page 13) cites Russell's col. 31, lines 10-18 for these features. However, this cited section does not relate to a reference clock unit and/or a reference clock unit to provide a signal (or synchronous signal) of the clock unit to an up-converter unit and a plurality of down-converter units. Accordingly, the applied references do not teach or suggest

these features of dependent claim 5 either alone or in combination with the other features of each of claims 1-4. Thus, dependent claim 5 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 6**

Dependent claim 6 depends from dependent claim 2 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 6 contains additional features such that dependent claim 6 does not stand or fall together with independent claim 1 and/or dependent claim 2. For example, dependent claim 6 recites that the antenna comprises a diversity antenna.

The Office Action (on page 4) cites Russell's diversity antenna 520. However, the antenna 520 is not coupled to the claimed duplex. Rather, Russell's alleged duplexer is connected to antenna 516. Accordingly, the applied references do not teach or suggest these features of dependent claim 6 either alone or in combination with the other features of independent claim 1 and/or dependent claim 2. Thus, dependent claim 6 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 7**

Dependent claim 7 depends from independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 7 contains additional features such that dependent claim 7 does not stand or fall together with independent claim 1. For example, dependent claim 7 recites that the optical connecting unit includes a



multiplexer/demultiplexer, an optical transceiver and a clock unit. The multiplexer/demultiplexer configured to multiplex the first digital I/Q signals. The optical transceiver configured to convert output signals of the multiplexer/demultiplexer into the optical signals and transmit the optical signals through the optical cable to the optical base station. The clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.

The Office Action (on page 4) cites Russell's FIG. 28 for the features of dependent claim 7. The Office Action states that Russell's QAM modulator 460 corresponds to the claimed multiplexer/demultiplexer. However, the QAM modulator 460 (of the AM modulator/demodulator 338) (FIG. 17) does not receive digital I/Q signals from a base station. See, for example, independent claim 1. The Office Action also cites Russell's col. 31, lines 3-9 for the claimed clock unit. However, the cited section does not relate to a clock unit to provide a synchronous signal to a multiplexer/demultiplexer unit (of an optical connecting unit). Additionally, the Advisory Action (on page 2) states that Russell does not explicitly show the claimed clock unit. Russell's disclosure at col. 31, lines 3-9 does not suggest a clock unit to provide a synchronous signal to a multiplexer/ demultiplexer unit (of an optical connecting unit). Accordingly, the applied references do not teach or suggest these features of dependent claim 7 either alone or in combination with the other features of independent claim 1. Thus, dependent claim 7 defines patentable subject matter at least for this additional reason.

**Dependent Claim 8**

Dependent claim 8 depends from dependent claim 7 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 8 contains additional features such that dependent claim 8 does not stand or fall together with independent claim 1 and/or dependent claim 7. For example, dependent claim 8 recites that the optical transceiver is further configured to receive optical signals from the optical base station and convert the received optical signals into third digital I/Q signals to be transmitted to the base station.

The Office Action cites Russell's AM optical receiver 466 (FIG. 28) for these features. However, the receiver 466 does not teach to convert received optical signals into digital I/Q signals. Accordingly, the applied references do not teach or suggest these features of dependent claim 8 either alone or in combination with the other features of independent claim 1. Thus, dependent claim 8 defines patentable subject matter at least for this additional reason.

**Dependent Claim 9**

Dependent claim 9 depends from independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 9 contains additional features such that dependent claim 9 does not stand or fall together with independent claim 1. For example, dependent claim 9 recites that the optical connecting unit receives the first digital I/Q signals from at least one channel card of the base station.

The Office Action (on pages 13-14) states that Russell does not disclose at least one channel card. The Office Action then states that it would have been obvious to specifically use transmitters in channel cards. However, Russell has no suggestion for receiving digital I/Q signals from a channel card (or from a channel card of a base station). Accordingly, the applied references do not teach or suggest these features of dependent claim 9 either alone or in combination with the other features of independent claim 1. Thus, dependent claim 9 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 10**

Dependent claim 10 depends from independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 10 contains additional features such that dependent claim 10 does not stand or fall together with independent claim 1. For example, dependent claim 10 recites that the optical base station and the optical connecting unit are digital interface-based devices.

Russel does not suggest these features as Russell does not disclose a digital interfaced optical base station and a digital interfaced optical connecting unit. Accordingly, the applied references do not teach or suggest these features of dependent claim 10 either alone or in combination with the other features of independent claim 1. Thus, dependent claim 10 defines patentable subject matter at least for this additional reason.

**Dependent Claim 37**

Dependent claim 37 depends from dependent claim 7 and independent claim 1, and therefore defines patentable subject matter at least for this reason. However, dependent claim 37 contains additional features such that dependent claim 37 does not stand or fall together with independent claim 1 and/or dependent claim 7. For example, dependent claim 37 recites that the multiplexer/demultiplexer (of the optical base station) converts the first digital I/Q signals from parallel to serial.

The Office Action (on page 12) cites Russell's column 8, lines 56-64 for these features. However, this cited section relates to a digital transmitter/receiver unit 130. See FIGs. 3-4. This section does not correspond to the claimed optical base station having the claimed multiplexer/demultiplexer. Accordingly, the applied references do not teach or suggest these features of dependent claim 37 either alone or in combination with the other features of independent claim 1 and/or dependent claim 7. Thus, dependent claim 37 defines patentable subject matter at least for this additional reason.

**Independent Claim 11**

Independent claim 11 recites converting first digital I/Q signals outputted from a base station into optical signals as well as transmitting the optical signals through an optical cable to an optical base station. For at least similar reasons as set forth above, Russell does not teach or suggest the first digital I/Q signals outputted from a base station. That is, Russell clearly describes that the base station 330 outputs RF signals. See column 15, lines 31-48 and FIG. 3.

Russell therefore does not convert digital I/Q signal outputted from the base station 330. As stated above, there is no suggestion to interpret Russell's base station 330 to include the head end unit 332 and the AM modulator/demodulator 338.

Furthermore, Russell does not teach or suggest transmitting the optical signals through an optical cable to an optical base station. The Office Action (on page 2 relating to independent claim 1) asserts that Russell's optical node 342 (FIGs. 17 and 29) corresponds to the claimed optical base station. See also page 5, lines 1-2 of the Office Action. However, applicants respectfully submit that the optical node 342 is not an optical base station. Furthermore, FIG. 29 is described as being related to an optical node (as compared to a base station). See column 6, lines 59-61. There is no suggestion in Russell for the features of an optical base station as would be known to one skilled in the art.

For at least the reasons set forth above, the applied references do not teach or suggest all the features of independent claim 11. Thus, independent claim 11 defines patentable subject matter at least for this reason.

#### **Dependent Claim 12**

Dependent claim 12 depends from independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 12 contains additional features such that dependent claim 12 does not stand or fall together with independent claim 11. For example, dependent claim 12 recites that converting the second digital I/Q signals to RF signals includes: demultiplexing the second digital I/Q signals;

converting the demultiplexed signals to analog signals; band pass filtering the analog signals to generate the RF signals; high-power amplifying the RF signals; and filtering the amplified RF signals.

The Office Action (on page 5) cites Russell's FIG. 29 as disclosing the features of dependent claim 12. However, FIG. 29 does not suggest the features of an optical base station (i.e., relating to the converting recited in independent claim 11). Accordingly, the applied references do not teach or suggest these features of dependent claim 12 either alone or in combination with the other features of independent claim 11. Thus, dependent claim 12 defines patentable subject matter at least for this additional reason.

### **Dependent Claim 13**

Dependent claim 13 depends from dependent claim 12 and independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 13 contains additional features such that dependent claim 13 does not stand or fall together with independent claim 11 and/or dependent claim 12. For example, dependent claim 13 recites that demultiplexing is performed in accordance with a synchronous signal.

The Office Action (on page 5) cites Russell's column 31, lines 43-60 for these features. However, this cited section does not relate to a synchronous signal. Further, this section relates to Russell's FIG. 47 showing a remote unit 904 (of FIG. 42). Accordingly, the applied references do not teach or suggest these features of dependent claim 13 either alone or in

combination with the other features of independent claim 11 and/or dependent claim 12. Thus, dependent claim 13 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 14**

Dependent claim 14 depends from independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 14 contains additional features such that dependent claim 14 does not stand or fall together with independent claim 11. For example, dependent claim 14 recites converting the first digital I/Q signals to the optical signals comprises multiplexing the first digital I/Q signals.

The Office Action (on page 5) cites Russell's QAM modulator 460 (FIG. 28) for these features. However, the QAM modulator 460 does not convert digital I/Q signals outputted from a base station (as recited in independent claim 11). Accordingly, the applied references do not teach or suggest these features of dependent claim 14 either alone or in combination with the other features of independent claim 11. Thus, dependent claim 14 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 15**

Dependent claim 15 depends from dependent claim 14 and independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 15 contains additional features such that dependent claim 15 does not stand or fall together with independent claim 11 and/or dependent claim 14. For example, dependent claim 15 recites that multiplexing is performed in accordance with a synchronous signal.

The Office Action (on page 5) cites Russell's column 31, lines 43-60 for these features. However, this cited section does not relate to a synchronous signal. Rather, this section relates to Russell's FIG. 47 showing a remote unit 904 (of FIG. 42). Accordingly, the applied references do not teach or suggest these features of dependent claim 15 either alone or in combination with the other features of independent claim 11 and/or dependent claim 14. Thus, dependent claim 15 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 16**

Dependent claim 16 depends from independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 16 contains additional features such that dependent claim 16 does not stand or fall together with independent claim 11. For example, dependent claim 16 recites the antenna comprises a diversity antenna. The applied references do not teach or suggest these features of dependent claim 16 either alone or in combination with the other features of independent claim 11. Thus, dependent claim 16 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 17**

Dependent claim 17 depends from dependent claim 12 and independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 17 contains additional features such that dependent claim 17 does not stand or fall together with independent claim 11 and/or dependent claim 12. For example, dependent claim 17 recites receiving RF signals through the antenna. The applied references do not teach or suggest these



features of dependent claim 17 either alone or in combination with the other features of independent claim 11 and/or dependent claim 12. Thus, dependent claim 17 defines patentable subject matter at least for this additional reason.

### **Dependent Claim 38**

Dependent claim 38 depends from independent claim 11, and therefore defines patentable subject matter at least for this reason. However, dependent claim 38 contains additional features such that dependent claim 38 does not stand or fall together with independent claim 11. For example, dependent claim 38 recites that converting the first digital I/Q signals comprises converting the first digital I/Q signals from parallel to serial.

The Office Action (on page 12) cites Russell's column 8, lines 56-64. However, the cited section relates to a digital transmitter/receiver unit 130. See FIGs. 3-4. This cited section does not correspond to the claimed optical base station (in independent claim 11) having the ability to convert digital I/Q signals from parallel to serial. Accordingly, the applied references do not teach or suggest these features of dependent claim 38 in combination with the other features of independent claim 11. Thus, dependent claim 38 defines patentable subject matter at least for this additional reason.

### **Independent Claim 18**

Independent claim 18 recites receiving RF signals through an antenna of a remote base station. Independent claim 18 also recites converting the digital optical signals to second digital electronic signals in the optical connecting unit, where the second digital electronic signals

including in phase and quadrature phase (I/Q) signals. Furthermore, independent claim 18 recites providing the second digital electronic signals from the optical connecting unit to a base station.

For at least similar reasons as set forth above, Russell does not teach or suggest at least these features of independent claim 18. More specifically, Russell does not teach or suggest providing the second digital electronic signals from the optical connecting unit to a base station, where the second digital electronic signals include in phase and quadrature phase (I/Q) signals. That is, Russell clearly describes that the base station 330 relates to RF signals. See column 15, lines 31-48 and FIG. 3. Russell therefore does not provide digital I/Q signals from an optical connecting unit to a base station. As stated above, there is no suggestion to interpret Russell's base station 330 to include the head end unit 332 and the AM modulator/demodulator 338.

For at least the reasons set forth above, Russell does not teach or suggest all the features of independent claim 18. Thus, independent claim 18 defines patentable subject matter at least for these reasons.

#### **Dependent Claim 19**

Dependent claim 19 depends from independent claim 18, and therefore defines patentable subject matter at least for this reason. However, dependent claim 19 contains additional features such that dependent claim 19 does not stand or fall together with independent claim 18. For example, dependent claim 19 recites the optical link comprises an optical cable. The applied references do not teach or suggest these features of dependent claim

19 either alone or in combination with the other features of independent claim 18. Thus, dependent claim 19 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 21**

Dependent claim 21 depends from independent claim 18, and therefore defines patentable subject matter at least for this reason. However, dependent claim 21 contains additional features such that dependent claim 21 does not stand or fall together with independent claim 18. For example, dependent claim 21 recites the antenna comprises a diversity antenna. The applied references do not teach or suggest these features of dependent claim 21 either alone or in combination with the other features of independent claim 18. Thus, dependent claim 21 defines patentable subject matter at least for this additional reason.

#### **Independent Claim 26**

Independent claim 26 recites receiving digital I/Q signals from a base station, converting the digital I/Q signals to optical signals in an optical connecting unit, transferring the optical signals over an optical cable to a remote station and converting the optical signals into RF signals for transmission.

For at least similar reasons as set forth above, Russell does not teach or suggest the claimed features relating to receiving digital I/Q signals from a base station. That is, Russell clearly describes that the base station 330 outputs RF signals. See column 15, lines 31-48 and FIG. 3. Russell therefore does not receive digital I/Q signals from a base station. As stated

above, there is no suggestion to interpret Russell's base station 330 to include the head end unit 332 and the AM modulator/demodulator 338.

Additionally, Russell does not suggest transferring the optical signals over an optical cable to a remote station. The Office Action (on page 9) asserts that Russell's optical node 342 (FIG. 29) corresponds to the claimed remote station. However, applicants respectfully submit that the optical node 342 is not a remote base station. Furthermore, FIG. 29 is described as being related to an optical node (as compared to a remote station). See column 6, lines 59-61. There is no suggestion in Russell for the features of a remote base station.

For at least the reasons set forth above, Russell does not teach or suggest all the features of independent claim 28. Thus, independent claim 26 defines patentable subject matter at least for this reason.

#### **Dependent Claim 28**

Dependent claim 28 depends from independent claim 26, and therefore defines patentable subject matter at least for this reason. However, dependent claim 28 contains additional features such that dependent claim 28 does not stand or fall together with independent claim 26. For example, dependent claim 28 recites that converting the optical signals includes: converting the optical signals into analog signal; demultiplexing the analog signals; up converting and filtering the demultiplexed analog signals to generate the RF signals; and amplifying and filtering the RF signals.

The Office Action (on page 9) cites features in Russell's FIG. 29 as disclosing features of dependent claim 28. However, FIG. 29 does not suggest the features of a remote station. Accordingly, the applied references do not teach or suggest these features of dependent claim 28 either alone or in combination with the other features of independent claim 26. Thus, dependent claim 28 defines patentable subject matter at least for this additional reason.

### **Dependent Claim 29**

Dependent claim 29 depends from independent claim 26, and therefore defines patentable subject matter at least for this reason. However, dependent claim 29 contains additional features such that dependent claim 29 does not stand or fall together with independent claim 26. For example, dependent claim 29 recites converting the digital I/Q signals comprises multiplexing the digital I/Q signals and inputting the multiplexed digital I/Q signals into an optical transceiver to generate the optical signals.

The Office Action (on pages 9-10) cites Russell's QAM modulator 460 (FIG. 28) and AM optical transmitter 462 for these features. However, the QAM modulator 460 does not convert digital I/Q signals received from a base station. Accordingly, the applied references do not teach or suggest these features of dependent claim 29 either alone or in combination with the other features of independent claim 26. Thus, dependent claim 29 defines patentable subject matter at least for this additional reason.

**Dependent Claim 30**

Dependent claim 30 depends from independent claim 26, and therefore defines patentable subject matter at least for this reason. However, dependent claim 30 contains additional features such that dependent claim 30 does not stand or fall together with independent claim 26. For example, dependent claim 30 recites receiving external RF signals through an antenna coupled to the remote station; converting the external RF signals to second optical signals; transferring the second optical signals to the optical connecting unit; and converting the second optical signals to second digital I/Q signals. The applied references do not teach or suggest these features of dependent claim 30 either alone or in combination with the other features of independent claim 26. Thus, dependent claim 30 defines patentable subject matter at least for this additional reason.

**Dependent Claim 40**

Dependent claim 40 depends from independent claim 26, and therefore defines patentable subject matter at least for this reason. However, dependent claim 40 contains additional features such that dependent claim 40 does not stand or fall together with independent claim 26. For example, dependent claim 40 recites converting the digital I/Q signals comprises converting the digital I/Q signals from parallel to serial. The applied references do not teach or suggest these features of dependent claim 40 either alone or in combination with the other features of independent claim 26. Thus, dependent claim 40 defines patentable subject matter at least for this additional reason.

**Independent Claim 31**

Independent claim 31 recites a remote base station coupled to receive the first digital optical signals and configured to convert the first digital optical signals to first analog RF signals for transmission.

For at least similar reasons as set forth above, Russell does not teach or suggest the claimed remote base station as recited in independent claim 31. The Office Action (on page 10) asserts that Russell's optical node 342 (FIGs. 17 and 29) corresponds to the claimed remote base station. However, applicants respectfully submit that the optical node 342 is not an remote base station. Furthermore, FIG. 29 is described as being related to an optical node (as compared to a remote base station). See column 6, lines 59-61. There is no suggestion in Russell for the features of a remote base station.

For at least the reasons set forth above, Russell does not teach or suggest all the features of independent claim 31. Thus, independent claim 31 defines patentable subject matter at least for this reason.

**Dependent Claim 32**

Dependent claim 32 depends from independent claim 31, and therefore defines patentable subject matter at least for this reason. However, dependent claim 32 contains additional features such that dependent claim 32 does not stand or fall together with independent claim 31. For example, dependent claim 32 recites the base station is further configured to receive second RF analog signals and convert the second analog RF signals to

second digital optical signals, and wherein the optical connecting unit is coupled to receive the second digital optical signals and further configured to convert the second digital optical signals to second digital I/Q signals for transmission.

The Office Action cites Russell's element 342 for these features. However, element 342 is an optical node. Thus, Russell does not teach or suggest these features of dependent claim 32 (relating to a remote base station) either alone or in combination with the other features of independent claim 31. Thus, dependent claim 32 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 41**

Dependent claim 41 depends from independent claim 31, and therefore defines patentable subject matter at least for this reason. However, dependent claim 41 contains additional features such that dependent claim 41 does not stand or fall together with independent claim 31. For example, dependent claim 41 recites the optical connecting unit converts the first digital I/Q signals from parallel to serial.

The Office Action (on page 12) cites Russell's column 8, lines 56-64 for these features. However, the cited section relates to a digital transmitter/receiver unit 130. See FIGs. 3-4. This section does not correspond to the optical connecting unit to convert digital I/Q signals from parallel to serial. Accordingly, the applied references do not teach or suggest these features of dependent claim 41 either alone or in combination with the other features of independent claim 31. Thus, dependent claim 41 defines patentable subject matter at least for this additional reason.



**Independent Claim 33**

Still further, independent claims 33 recites a remote base station, coupled to receive the first optical signals, and configured to convert the first optical signals to third digital I/Q signals, convert the third digital I/Q signals to first RF signals, transmit the first RF signals, receive second RF signals, convert the second RF signals to fourth digital I/Q signals, and convert the fourth digital I/Q signals to the second optical signals.

For at least similar reasons as set forth above, Russell does not teach or suggest the claimed remote base station as recited in independent claim 33. The Office Action (on page 11) asserts that Russell's optical node 342 (FIGs. 17 and 29) corresponds to the claimed remote base station. However, applicants respectfully submit that the optical node 342 is not an remote base station. Furthermore, FIG. 29 is described as being related to an optical node (as compared to a remote base station). See column 6, lines 59-61. There is no suggestion in Russell for the features of a remote base station. Accordingly, independent claim 33 defines patentable subject matter at least for this reason.

**Dependent Claim 34**

Dependent claim 34 depends from independent claim 33, and therefore defines patentable subject matter at least for this reason. However, dependent claim 34 contains additional features such that dependent claim 34 does not stand or fall together with independent claim 33. For example, dependent claim 34 recites an optical link coupling the optical connecting unit to the remote base station. Russell does not suggest an optical link that

couples to a remote base station. Accordingly, the applied references do not teach or suggest these features of dependent claim 34 either alone or in combination with the other features of independent claim 33. Thus, dependent claim 34 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 35**

Dependent claim 35 depends from independent claim 33, and therefore defines patentable subject matter at least for this reason. However, dependent claim 35 contains additional features such that dependent claim 35 does not stand or fall together with independent claim 33. For example, dependent claim 35 recites the remote base station comprises a diversity antenna. The applied references do not teach or suggest these features of dependent claim 35 either alone or in combination with the other features of independent claim 33. Thus, dependent claim 35 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 36**

Dependent claim 36 depends from independent claim 33, and therefore defines patentable subject matter at least for this reason. However, dependent claim 36 contains additional features such that dependent claim 36 does not stand or fall together with independent claim 33. For example, dependent claim 36 recites the optical connecting unit comprises a multiplexer configured to multiplex the first digital I/Q signals and a demultiplexer configured to demultiplex the second digital I/Q signals, and wherein the remote base station

comprises a demultiplexer configured to demultiplex the third digital I/Q signals and a multiplexer configured to multiplex the fourth digital I/Q signals.

The Office Action (on pages 11-12) cites Russell's QAM demodulator 502 and QAM modulator 536 as corresponding to the claimed features of a remote base station. However, the QAM demodulator 502 and QAM modulator 536 are not provided in a remote base station. Accordingly, the applied references do not teach or suggest these features of dependent claim 36 either alone or in combination with the other features of independent claim 33. Thus, dependent claim 36 defines patentable subject matter at least for this additional reason.

#### **Dependent Claim 42**

Dependent claim 42 depends from independent claim 33, and therefore defines patentable subject matter at least for this reason. However, dependent claim 42 contains additional features such that dependent claim 42 does not stand or fall together with independent claim 33. For example, dependent claim 42 recites the optical connecting unit converts the first digital I/Q signals from parallel to serial.

The Office Action (on page 12) cites Russell's column 8, lines 56-64 for these features. However, the cited section relates to a digital transceiver/receiver unit 130. See FIGs. 3-4. This section does not correspond to the claimed optical connecting unit converting first digital I/Q signals from parallel to serial. Accordingly, the applied references do not teach or suggest these features of dependent claim 42 either alone or in combination with the other features of

independent claim 33. Thus, dependent claim 42 defines patentable subject matter at least for this additional reason.

### **CLAIMS APPENDIX**

The attached Claims Appendix A contains a copy of the claims involved in the appeal after entry of the Second Amendment After Final Rejection.

The attached claims Appendix B contains a copy of the claims involved in the appeal prior to entry of the Second Amendment After Final Rejection.

### **EVIDENCE APPENDIX**

Applicant has not provided any evidence with this appeal and therefore an Evidence Appendix is not provided.

### **RELATED PROCEEDINGS APPENDIX**

Applicant is not providing copies of related decisions and therefore a Related Proceeding Appendix is not provided.

### **CONCLUSION**

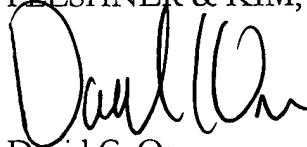
It is respectfully submitted that the above arguments show that each of claims 1-19, 21, 26, 28-38 and 40-42 are patentable over the applied references. Based at least on these reasons,

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it is respectfully submitted that each of claims 1-19, 21, 26, 28-38 and 40-42 defines patentable subject matter. Applicants respectfully request that the rejections of claims 1-19, 21, 26, 28-38 and 40-42 set forth in the August 24, 2005 Office Action be withdrawn.

Respectfully submitted,  
FLESHNER & KIM, LLP

A handwritten signature in black ink, appearing to read "David C. Oren", is written over the firm name.

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**Date: May 23, 2006**

Attachments: Claims Appendix A  
Claims Appendix B

**CLAIMS APPENDIX A**

1. A communications system, comprising:
  - a base station configured to output first digital in phase and quadrature phase (I/Q) signals;
  - an optical connecting unit configured to convert the first digital I/Q signals into optical signals and output the converted optical signals through an optical cable; and
  - an optical base station coupled to receive the optical signals through the optical cable and configured to convert the optical signals into second digital I/Q signals, and convert the second digital I/Q signals into first RF signals for transmission.
2. The system of claim 1, wherein the optical base station comprises:
  - an optical transceiver configured to convert the optical signals received through the optical cable into the second digital I/Q signals;
  - a multiplexer/demultiplexer unit configured to demultiplex the second digital I/Q signals outputted from the optical transceiver;
  - an up-converter configured to convert and filter output signals of the multiplexer/demultiplexer unit and output the first RF signals;
  - a High Power Amplifier (HPA) configured to amplify the first RF signals outputted by the up-converter; and
  - a duplexer configured to filter the amplified first RF signals and provide the filtered output to an antenna.

3. The system of claim 2, wherein the optical base station further comprises:  
a plurality of duplexers configured to remove a noise component of second RF signals collected by a corresponding plurality of antennas;  
a plurality of Low Noise Amplifiers (LNAs) configured to amplify the second RF signals outputted from the plurality of duplexers; and  
a plurality of down-converter units configured to band-pass filter, down-convert and analog to digital convert, the second RF signals outputted from the plurality of LNAs.
4. The system of claim 3, wherein the optical base station further comprises a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.
5. The system of claim 4, wherein the optical base station further comprises a reference clock unit configured to provide the synchronous signal of the clock unit to the up-converter unit and the plurality of down-converter units.
6. The system of claim 2, wherein the antenna comprises a diversity antenna.

7. The system of claim 1, wherein the optical connecting unit comprises:  
a multiplexer/demultiplexer configured to multiplex the first digital I/Q signals;  
an optical transceiver configured to convert output signals of the multiplexer/demultiplexer into the optical signals and transmit the optical signals through the optical cable to the optical base station; and  
a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.
8. The system of claim 7, wherein the optical transceiver is further configured to receive optical signals from the optical base station and convert the received optical signals into third digital I/Q signals to be transmitted to the base station.
9. The system of claim 1, wherein the optical connecting unit receives the first digital I/Q signals from at least one channel card of the base station.
10. The system of claim 1, wherein the optical base station and the optical connecting unit are digital interface-based devices.



11. A signal transmitting method for a communications system, comprising:
  - converting first digital I/Q signals outputted from a base station into optical signals;
  - transmitting the optical signals through an optical cable to an optical base station;
  - converting the optical signals received through the optical cable into second digital I/Q signals;
  - converting the second digital I/Q signals into RF signals; and
  - transmitting the RF signals through an antenna.
12. The method of claim 11, wherein converting the second digital I/Q signals to RF signals comprises:
  - demultiplexing the second digital I/Q signals;
  - converting the demultiplexed signals to analog signals;
  - band pass filtering the analog signals to generate the RF signals;
  - high-power amplifying the RF signals; and
  - filtering the amplified RF signals.
13. The method of claim 12, wherein demultiplexing is performed in accordance with a synchronous signal.

14. The method of claim 11, wherein converting the first digital I/Q signals to the optical signals comprises multiplexing the first digital I/Q signals.

15. The method of claim 14, wherein multiplexing is performed in accordance with a synchronous signal.

16. The method of claim 11, wherein the antenna comprises a diversity antenna.

17. The method of claim 12, further comprising receiving RF signals through the antenna.

18. A signal receiving method for a communications system, comprising:  
receiving RF signals through an antenna of a remote base station;  
converting the received RF signals to first digital electronic signals;  
converting the first digital electronic signals to digital optical signals;  
transmitting the digital optical signals over an optical link to an optical connecting unit;  
converting the digital optical signals to second digital electronic signals in the optical connecting unit, the second digital electronic signals including in phase and quadrature phase (I/Q) signals; and

providing the second digital electronic signals from the optical connecting unit to a base station.

19. The method of claim 18, wherein the optical link comprises an optical cable.
21. The method of claim 18, wherein the antenna comprises a diversity antenna.
26. A signal transmitting method in a communication system, comprising:  
receiving digital I/Q signals from a base station;  
converting the digital I/Q signals to optical signals in an optical connecting unit;  
transferring the optical signals over an optical cable to a remote station; and  
converting the optical signals into RF signals for transmission.
28. The method of claim 26, wherein converting the optical signals comprises:  
converting the optical signals into analog signal;  
demultiplexing the analog signals;  
up converting and filtering the demultiplexed analog signals to generate the RF signals; and  
amplifying and filtering the RF signals.

29. The method of claim 26, wherein converting the digital I/Q signals comprises multiplexing the digital I/Q signals and inputting the multiplexed digital I/Q signals into an optical transceiver to generate the optical signals.

30. The method of claim 26, further comprising:  
receiving external RF signals through an antenna coupled to the remote station;  
converting the external RF signals to second optical signals;  
transferring the second optical signals to the optical connecting unit; and  
converting the second optical signals to second digital I/Q signals.

31. A communication system, comprising:  
an optical connecting unit, configured to receive first digital I/Q signals and convert the first digital I/Q signals into first digital optical signals; and  
a remote base station, coupled to receive the first digital optical signals and configured to convert the first digital optical signals to first analog RF signals for transmission.

32. The system of claim 31, wherein the base station is further configured to receive second RF analog signals and convert the second analog RF signals to second digital optical signals, and wherein the optical connecting unit is coupled to receive the second digital optical signals and further configured to convert the second digital optical signals to second digital I/Q signals for transmission.

33. A communication system, comprising:
- an optical connection unit, configured to convert first digital I/Q signals to first optical signals and to convert second optical signals to second digital I/Q signals; and
- a remote base station, coupled to receive the first optical signals, and configured to convert the first optical signals to third digital I/Q signals, convert the third digital I/Q signals to first RF signals, transmit the first RF signals, receive second RF signals, convert the second RF signals to fourth digital I/Q signals, and convert the fourth digital I/Q signals to the second optical signals.
34. The system of claim 33, further comprising an optical link coupling the optical connecting unit to the remote base station.
35. The system of claim 33, wherein the remote base station comprises a diversity antenna.
36. The system of claim 33, wherein the optical connecting unit comprises a multiplexer configured to multiplex the first digital I/Q signals and a demultiplexer configured to demultiplex the second digital I/Q signals, and wherein the remote base station comprises a demultiplexer configured to demultiplex the third digital I/Q signals and a multiplexer configured to multiplex the fourth digital I/Q signals.

37. The system of claim 7, wherein the multiplexer/demultiplexer converts the first digital I/Q signals from parallel to serial.

38. The method of claim 11, wherein converting the first digital I/Q signals comprises converting the first digital I/Q signals from parallel to serial.

40. The method of claim 26, wherein converting the digital I/Q signals comprises converting the digital I/Q signals from parallel to serial.

41. The system of claim 31, wherein the optical connecting unit converts the first digital I/Q signals from parallel to serial.

42. The system of claim 33, wherein the optical connecting unit converts the first digital I/Q signals from parallel to serial.

**CLAIMS APPENDIX B**

1. A communications system, comprising:
  - a base station configured to output first digital in phase and quadrature phase (I/Q) signals;
  - an optical connecting unit configured to convert the first digital I/Q signals into optical signals and output the converted optical signals through an optical cable; and
  - an optical base station coupled to receive the optical signals through the optical cable and configured to convert the optical signals into second digital I/Q signals, and convert the second digital I/Q signals into first RF signals for transmission.
  
2. The system of claim 1, wherein the optical base station comprises:
  - an optical transceiver configured to convert the optical signals received through the optical cable into the second digital I/Q signals;
  - a multiplexer/demultiplexer unit configured to demultiplex the second digital I/Q signals outputted from the optical transceiver;
  - an up-converter configured to convert and filter output signals of the multiplexer/demultiplexer unit and output the first RF signals;
  - a High Power Amplifier (HPA) configured to amplify the first RF signals outputted by the up-converter; and
  - a duplexer configured to filter the amplified first RF signals and provide the filtered output to an antenna.

3. The system of claim 2, wherein the optical base station further comprises:  
a plurality of duplexers configured to remove a noise component of second RF signals collected by a corresponding plurality of antennas;  
a plurality of Low Noise Amplifiers (LNAs) configured to amplify the second RF signals outputted from the plurality of duplexers; and  
a plurality of down-converter units configured to band-pass filter, down-convert and analog to digital convert, the second RF signals outputted from the plurality of LNAs.
4. The system of claim 3, wherein the optical base station further comprises a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.
5. The system of claim 4, wherein the optical base station further comprises a reference clock unit configured to provide the synchronous signal of the clock unit to the up-converter unit and the plurality of down-converter units.
6. The system of claim 2, wherein the antenna comprises a diversity antenna.



7. The system of claim 1, wherein the optical connecting unit comprises:  
a multiplexer/demultiplexer configured to multiplex the first digital I/Q signals;  
an optical transceiver configured to convert output signals of the multiplexer/demultiplexer into the optical signals and transmit the optical signals through the optical cable to the optical base station; and  
a clock unit configured to provide a synchronous signal to the multiplexer/demultiplexer unit.
8. The system of claim 7, wherein the optical transceiver is further configured to receive optical signals from the optical base station and convert the received optical signals into third digital I/Q signals to be transmitted to the base station.
9. The system of claim 1, wherein the optical connecting unit receives the first digital I/Q signals from at least one channel card of the base station.
10. The system of claim 1, wherein the optical base station and the optical connecting unit are digital interface-based devices.

11. A signal transmitting method for a communications system, comprising:  
converting first digital I/Q signals outputted from a base station into optical signals;  
transmitting the optical signals through an optical cable to an optical base station;  
converting the optical signals received through the optical cable into second digital I/Q signals;  
converting the second digital I/Q signals into RF signals; and  
transmitting the RF signals through an antenna.

12. The method of claim 11, wherein converting the second digital I/Q signals to RF signals comprises:  
demultiplexing the second digital I/Q signals;  
converting the demultiplexed signals to analog signals;  
band pass filtering the analog signals to generate the RF signals;  
high-power amplifying the RF signals; and  
filtering the amplified RF signals.

13. The method of claim 12, wherein demultiplexing is performed in accordance with a synchronous signal.

14. The method of claim 11, wherein converting the first digital I/Q signals to the optical signals comprises multiplexing the first digital I/Q signals.

15. The method of claim 14, wherein multiplexing is performed in accordance with a synchronous signal.

16. The method of claim 11, wherein the antenna comprises a diversity antenna.

17. The method of claim 12, further comprising receiving RF signals through the antenna.

18. A signal receiving method for a communications system, comprising:  
receiving RF signals through an antenna of a remote base station;  
converting the received RF signals to first digital electronic signals;  
converting the first digital electronic signals to digital optical signals;  
transmitting the digital optical signals over an optical link to an optical connecting unit;

converting the digital optical signals to second digital electronic signals in the optical coupling unit, the second digital electronic signals including in phase and quadrature phase (I/Q) signals; and

providing the second digital electronic signals from the optical coupling unit to a base station.

19. The method of claim 18, wherein the optical link comprises an optical cable.
21. The method of claim 18, wherein the antenna comprises a diversity antenna.
26. A signal transmitting method in a communication system, comprising:  
receiving digital I/Q signals from a base station;  
converting the digital I/Q signals to optical signals in an optical connecting unit;  
transferring the optical signals over an optical cable to a remote station; and  
converting the optical signals into RF signals for transmission.
28. The method of claim 26, wherein converting the optical signals comprises:  
converting the optical signals into analog signal;  
demultiplexing the analog signals;  
up converting and filtering the demultiplexed analog signals to generate the RF signals; and  
amplifying and filtering the RF signals.

29. The method of claim 26, wherein converting the digital I/Q signals comprises multiplexing the digital I/Q signals and inputting the multiplexed digital I/Q signals into an optical transceiver to generate the optical signals.

30. The method of claim 26, further comprising:  
receiving external RF signals through an antenna coupled to the remote station;  
converting the external RF signals to second optical signals;  
transferring the second optical signals to the optical connecting unit; and  
converting the second optical signals to second digital I/Q signals.

31. A communication system, comprising:  
an optical connecting unit, configured to receive first digital I/Q signals and convert the first digital I/Q signals into first digital optical signals; and  
a remote base station, coupled to receive the first digital optical signals and configured to convert the first digital optical signals to first analog RF signals for transmission.

32. The system of claim 31, wherein the base station is further configured to receive second RF analog signals and convert the second analog RF signals to second digital optical signals, and wherein the optical connecting unit is coupled to receive the second digital optical signals and further configured to convert the second digital optical signals to second digital I/Q signals for transmission.

33. A communication system, comprising:  
an optical connection unit, configured to convert first digital I/Q signals to first optical signals and to convert second optical signals to second digital I/Q signals; and  
a remote base station, coupled to receive the first optical signals, and configured to convert the first optical signals to third digital I/Q signals, convert the third digital I/Q signals to first RF signals, transmit the first RF signals, receive second RF signals, convert the second RF signals to fourth digital I/Q signals, and convert the fourth digital I/Q signals to the second optical signals.

34. The system of claim 33, further comprising an optical link coupling the optical connecting unit to the remote base station.

35. The system of claim 33, wherein the remote base station comprises a diversity antenna.

36. The system of claim 33, wherein the optical connecting unit comprises a multiplexer configured to multiplex the first digital I/Q signals and a demultiplexer configured to demultiplex the second digital I/Q signals, and wherein the remote base station comprises a demultiplexer configured to demultiplex the third digital I/Q signals and a multiplexer configured to multiplex the fourth digital I/Q signals.

37. The system of claim 7, wherein the multiplexer/demultiplexer converts the first digital I/Q signals from parallel to serial.

38. The method of claim 11, wherein converting the first digital I/Q signals comprises converting the first digital I/Q signals from parallel to serial.

39. The system of claim 22, wherein the means for converting first digital I/Q electronic signals includes means for converting the first digital electronic I/Q signals from parallel to serial.

40. The method of claim 26, wherein converting the digital I/Q signals comprises converting the digital I/Q signals from parallel to serial.

41. The system of claim 31, wherein the optical connecting unit converts the first digital I/Q signals from parallel to serial.

42. The system of claim 33, wherein the optical connecting unit converts the first digital I/Q signals from parallel to serial.